NON-PUBLIC?: N
ACCESSION #: 9112130293
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Dresden Nuclear Power Station, Unit 2 PAGE: 1 OF 05

DOCKET NUMBER: 05000237

TITLE: Reactor Scram on Spurious Intermediate Range Monitor Hi-Hi
Signals Due to Electromagnetic Interference
EVENT DATE: 11/13/91 LER #: 91-037-00 REPORT DATE: 12/03/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 001

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: IG COMPONENT: XXXX MANUFACTURER: XXXX
REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 1541 hours on November 13, 1991, an automatic reactor scram occurred due to a spurious Hi-Hi neutron flux signal on the Intermediate Range Monitors (IRMs). A unit startup was in progress with reactor pressure at approximately 101 psig at the time of the scram. The scram functions that occurred were proper upon receipt of the spurious spikes. The spurious spikes occurred as a High Pressure Coolant Injection (HPCI) steam isolation valve was opened. An extensive investigation into the spiking determined the cause to be electromagnetic interference (EMI) produced by DC valve motor operation. The EMI was being picked up in the drywell by the IRM signal cables. During the last refueling outage, new stainless steel jacketed Whittaker signal cables were installed in the drywell outside of the IRM rigid conduit. Corrective actions involved rerouting the IRM signal cables in the drywell inside flexible conduit for additional shielding, and installation of varistors on HPCI 250 Vdc

valve motor circuitry to reduce the amount of EMI produced by valve operation. In addition, the IRM signal cables will be routed inside permanent rigid conduit during the next refueling outage. Previous similar events are documented by LERs 90-15/050237, 90-17/050237, and 91-18/050237.

END OF ABSTRACT

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Rea
tor - 2527 MWt rated core thermal
power

Nuclear Tracking System (NTS) tracking code numbers are identified in the text as (XXX-XXX-XX-XXXXX)

EVENT IDENTIFICATION

Reactor Scram on Spurious Intermediate Range Monitor IG! Hi-Hi Signals Due to Electromagnetic Interference

A. CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: November 13, 1991 Event Time: 1541 Hours

Reactor Mode: N Mode Name: Startup Power Level: 1%

Reactor Coolant System (RCS) Pressure: 101 psig

B. DESCRIPTION OF EVENT:

On November 13, 1991 at 1541 hours with a unit startup in progress, a simultaneous trip of Reactor Protection System (RPS) JE! Channels A and B was received when Intermediate Range Monitors (IRM) 11, 13, 14, 15, 17, and 18 spuriously spiked above the Technical Specification setpoint for Hi-Hi neutron flux (120/125 of scale). The simultaneous trip of both RPS channels resulted in a full reactor scram. The spikes occurred during unit heatup at approximately 101 psig reactor pressure when the High Pressure Coolant Injection (HPCI) BJ! steam isolation valve, M02-2301-5, reached its full open position. The valve was being opened to place HPCI in the standby mode in accordance with the Technical Specification HPCI Operability Requirement (prior to 150 psig).

Based on IRM readings, reactor power was approximately 1% at the time of the event. All control rods fully inserted, all immediate operator actions were successfully completed, and all systems functioned normally following the reactor scram.

C. APPARENT CAUSE OF EVENT:

This event is being reported in accordance with Title 10 of the Code of Federal Regulations (CFR) Part 50 Section 73(a)(2)(iv), which states that any event that results in manual or automatic actuation of any Engineered Safety Feature, including the RPS, must be reported.

An investigation into the IRM spiking was initiated by members of the Instrument Maintenance, Electrical Maintenance, and Technical Staff departments. Initial testing involved cycling various valves while recording all IRM indications on strip chart recorders at the IRM chassis in the control room. This testing was performed with the unit in the Shutdown mode and neutron monitoring RPS Channel B trips bypassed in accordance with a 10CFR 50.59 safety evaluation. In addition, all testing was performed with the IRMs set to range seven, which is considered to be most sensitive to EMI due to the fact that this range has the highest gain of the high frequency amplification ranges. The valves cycled for this testing included HPCI Valves 2-2301-4, 2301-5, 2301-6, and Isolation Condenser BL! valve 1301-2. In addition, the B Standby Gas Treatment (SBGT) BH! train was started and secured, and the Source Range Monitors (SRM) were driven in and out to determine their effect on the IRMs. In each test, IRMs 11, 13, 14, and 18 exhibited significant spiking. These IRMs, as well as IRMs 12 and 17, use Whittaker signal cable in the drywell which was routed outside of the conduit during the last refueling outage. IRM 12 was observed to spike, but not severely, and IRM 17 was inoperable throughout the test. IRM 15 also has a Whittaker signal cable, but at the time of the testing was routed in 3/4 inch Seal Tight flexible conduit. This IRM also spiked, but not as severely as 11, 13, 14, and 18. IRM 16 has an older type organic signal cable and is routed in 1-1/2 inch rigid conduit. It exhibited no noticeable spiking. A discharge resistor was added to the 2-2301-5 valve, and testing for this valve was repeated. In the initial testing of the 2-2301-5 valve, the spiking exhibited two distinct peaks. When tested after the discharge resistor was added, one of these peaks appeared to have been greatly reduced. Further testing was performed with several of the IRMs disconnected at the preamplifier. Each time an IRM was disconnected and a valve cycled, the spiking did not occur on the disconnected IRM circuit. This indicated that the interference causing the IRMs to spike was most likely entering the system through the signal cable in the drywell.

Results of the initial testing appeared to indicate that the flexible conduit and the discharge resistor were effective in reducing spiking, and conversations with General Electric system experts lent support to this assessment. It is believed that the spiking is a result of electromagnetic interference (EMI) created mainly by dc valve motor operation. When a valve is operated, the EMI produced propagates from the valve motor. The IRM signal cable, acting as an antenna, picks up the EMI and produces a spike. As a result, the decision was made to route all IRMs in pairs inside 1-1/4 inch grounded flexible conduit inside the drywell to provide additional shielding against EMI. IRM 15, which was previously routed inside 3/4 inch flexible conduit, was rerouted inside the 1-1/4 inch flexible conduit. IRM 16 was not rerouted and remains inside the original rigid conduit. In addition, a varistor was installed across the shunt field on the 2-2301-5 valve motor circuit breaker. The varistor is designed to reduce spiking in a similar manner as a discharge resistor, but is considered to be more suitable for this application.

Following completion of this work, additional testing was performed. This testing showed that the addition of the flexible conduit in conjunction with the varistor on the 2-2301-5 valve nearly eliminated the EMI spikes for all IRMs except 12 and 18. After consultation with General Electric, the decision was made to install additional ground cables to the flexible conduit for each of these IRMs. It was believed that the flexible conduit around these cables was not grounded sufficiently to dissipate the signal noise. Testing following installation of the additional ground cables showed that they did not eliminate the spiking for IRMs 12 and 18, but did reduce it. In addition, further testing showed that spikes of relatively large magnitude could be produced on several of the IRMs by cycling the HPCI 2-2301-6, 2301-8, 2301-9, 2301-15, 2301-35, and 2301-36 valves, and the Reactor Water Cleanup (RWCU) CE! 1201-2 valve. Tests were also performed on the HPCI 2-2301-3, 2301-4, 2301-10, 2301-14, 2301-48, and 2301-49 valves, but no significant EMI spiking was detected. Also, the HPCI Gland Seal Leakoff (GSLO) Blower Fan, HPCI Turning Gear Motor, HPCI GSLO Oil Cooler Pump, and HPCI Auxiliary Oil Pump were operated, but no significant EMI spikes were generated.

At this point, it was decided to install varistors on each of the valves that produced large magnitude EMI spikes valves-(2-2301-6, 2301-8, 2301-9, 2301-15, 2301-35, 2301-36, and 1201-2) in order to reduce the spiking. Following installation of the varistors, further testing was performed on all valves except the 2301-8, 2301-9, and 1201-2 valves. In each, case, severe EMI spiking was observed on IRM 12, and moderate spiking was noticeable on IRMs 15 and 18. At this time, however, IRM 12 indication had drifted above downscale. Following Instrument Maintenance troubleshooting which corrected the drifting problem, the 2-2301-5 valve was retested and the IRM 12 EMI spiking was greatly reduced. After varistor installation was complete on the 2-2301-8 and 2301-9 valves, they were also tested. Several EMI spikes were observed on IRMs 13, 15, and 18, but all were of a moderate magnitude. The varistor for the 2-1201-2 valve must be environmentally qualified prior to installation, and as such has not yet been installed.

This phenomenon of IRM spiking due to plant electrical noise (EMI) has been observed numerous times over the life of the plant. Since the most recent refueling outage on Unit 2 (D2R12), the spiking has become more frequent and more severe. It is believed that this increase in severity is the result of work performed on the IRM signal cables during the previous refuel outage (D2R12). During that outage, new Whittaker signal cables were installed inside the drywell for all SRMs and IRMs. These cables were routed outside of existing conduit, leaving the old cables inside the rigid conduit to serve as a backup. At the time, it was believed that the additional shielding provided by the conduit would not be necessary for the new stainless steel jacketed Whittaker signal cable. However, since this cable installation, numerous half scrams and three full reactor scrams have been attributed to IRM spiking. Prior to this most recent event, a commitment had been made to reroute the SRM and IRM signal cable inside rigid conduit in the drywell to alleviate the problem at the next refuel outage.

D. SAFETY ANALYSIS OF EVENT:

Four IRMs provide input into each of the two RPS channels. A flux indication exceeding the Hi-Hi setpoint on any IRM will cause a trip of its associated RPS channel. A simultaneous trip of both RPS channels will in turn produce a full reactor scram. In this event, multiple IRMs in each RPS channel reached the Hi-Hi trip setpoint of 120/125 of full scale, causing a full reactor scram. The Hi-Hi trip condition cleared immediately. Reactor heatup was in progress at the time of the event, but no activities were in progress that could have caused a sudden increase in neutron flux of the magnitude seen on the IRMs. In addition, repeated testing with the unit shutdown has shown consistently that operation of the M02-2301-5 valve would cause IRM spiking.

Due to the fact that this event clearly involved a spurious IRM spike rather than an actual neutron flux excursion, and since all systems responded as expected when challenged by the scram signals, the safety significance of this event was minimal.

E. CORRECTIVE ACTIONS:

Short term corrective actions involved rerouting all IRM cables except IRM 16 in the Unit 2 drywell inside 1-1/4 inch flexible conduit. This conduit was installed to provide additional shielding against EMI, which is the cause of the spiking. Also, varistors were installed on the 2-2301-5, 2301-6, 2301-8, 2301-9, 2301-35, and 2301-36 valves. A varistor will be installed on the 1201-2 valve when environmental qualification of the varistor is completed (237-200-91-20401). These varistors, installed across the valve motor shunt field, will reduce the amount of EMI created when these valves are cycled.

The Unit 2 SRM and IRM signal cables will be routed inside rigid conduit during the next Unit 2 refueling outage under Work Request D01217 (249-200-90-04302N). Unit 3 SRMs/IRMs also use Whittaker signal cables, but all cables inside the drywell are currently routed in rigid conduit. Unit 3 has not experienced SRM/IRM spiking problems similar to those encountered on Unit 2. However, testing will be performed on Unit 3 to determine the affect of the operation of dc powered valve motors on the SRMs and IRMs. Appropriate corrective actions, if any, will be determined based upon the results of the testing. This may include varistor installation (249-200-91-204
2). Also, a review of the SRM/IRM signal cabling and shielding configuration will be conducted to determine if any changes can be made that will enhance the reliability of the system (249-200-91-20403). This review may include an investigation into the possibility of installing alternative types of signal cables and connectors.

F. PREVIOUS OCCURRENCES:

LER/Docket Numbers Title

90-015-0/050237 Intermediate Range Monitor Full Scram Due to Inductive Noise Input to the IRM/SRM Power Supplies

Instrument Maintenance personnel were performing Dresden Instrument Surveillance (DIS) 1500-5, Low Pressure Coolant Injection BO! Containment Cooling Logic Test, with Unit 2 shut down for a refuel outage when a full reactor scram was received on IRM Hi-Hi flux signals. The IRM spike was attributed to inductive noise input to the SRM/IRM power supplies during relay actuation.

90-017-0/050237 Reactor Scram on Intermediate Range Monitor Hi-Hi Due to Unknown Cause

Two reactor scrams were received with Unit 2 shut down for a refuel outage when IRMs in both RPS channels spuriously spiked above their Hi-Hi setpoint simultaneously. Investigation and testing was performed concerning the source of the spikes, noting that the IRM cable routing was a potential factor. Subsequently, it was planned to reroute the IRM cables at the next refuel outage.

91-018-0/050237 Reactor Scram On Intermediate Range Monitor Hi-Hi due to System Noise

While performing Dresden Technical Surveillance (DTS) 500-2, Functional Testing of RPS Motor-Generator (MG) Sets and RPS Reserve Power Supply, a Hi-Hi spike on IRM 15 caused RPS Channel B to trip. At the time, RPS Channel A was already in a tripped condition for the surveillance testing. The simultaneous trip of both RPS channels resulted in a full reactor scram. Corrective actions involved a reference to work request 01217, which had been previously written to reroute all Unit 2 SRM and IRM signal cables inside rigid conduit in the drywell at the upcoming refuel outage.

G. COMPONENT FAILURE DATA:

Manufacturer Nomenclature Model Number Mfg. Part Number

General Electric Intermediate N/A N/A
Range Monitor
System

An industry wide Nuclear Plant Reliability Data System (NPRDS) data base search revealed several SRM/IRM spiking events due to various causes. However, no incidences of spiking caused by cable routing were reported.

ATTACHMENT 1 TO 9112130293 PAGE 1 OF 1

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CWS LTR #91-027

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Licensee Event Report 91-037, Docket 050237 is being submitted as required by Technical Specification 6.6, NUREG 1022 and 10 CFR 50.73(a)(2)(iv).

Charles W. Schroeder
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CWS/dwh

Enclosure

cc: A. Bert Davis, Regional Administrator, Region III
NRC Resident Inspector's Office
File/NRC
File/Numerical

(ZDVR/391)

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